IN THE DRAWING

With the concurrence of the Examiner, applicants have amended Figure 13 in the Replacement Sheet attached as an Appendix to this Amendment by moving the reference numerals 170_n, 170_{n-1}, and 170_{n-2} to the other side of the post-processors 168. The changes are shown by the red ink notation on the accompanying marked up copy of Figure 13 also attached.

REMARKS

Initially, the Examiner's attention is directed to three patents having identical drawings and similar written descriptions but different claims as the subject application. These patents are 6,904,085, 6,731,682, and 6,754,262.

In section 2 of the Office Action, the Examiner objected to the drawings requiring the reference numerals for the output paths shown in Figure 13 to be consistent with the post processors and the adder. The paths 170 are not output paths representing outputs of the post-processors 168. Instead, the paths 170 include the finite filters 166 and the post-processors 168. However, applicants propose to amend Figure 13 by moving the reference numerals 170_n, 170_{n-1}, and 170_{n-2} to the other side of the post-processors 168. Replacement sheets will be submitted accordingly.

In section 3 of the Office Action, the Examiner required certain changes to the specification. The specification has been accordingly amended.

In this section, the Examiner also objected to claims 10 and 11. Amendments have accordingly been made to these claims to overcome the Examiner's objection.

In section 5 of the Office Action, the Examiner rejected claims 1, 3-5, 7-13, 33, 34, 36, 37, 63, and 64 under 35 U.S.C. §103(a) as being unpatentable over Sommer in view of Citta.

Sommer shows a receiver 10 that has an antenna 12 and a front end 14. The front end 10 tunes to a particular frequency received by the antenna 12, downconverts this frequency to baseband, filters the out-of-band signals, performs analog to digital conversion (ADC) and gain control, and estimates and compensates for carrier and symbol clock phase and frequency errors.

The output of the front-end unit 14 is sampled at the symbol rate and the sampled signal is equalized by an adaptive equalizer 16. The output of the equalizer 16 is fed into a phase recovery unit 18, and the output of the phase recovery unit 18 is then input to a detection unit 20 that includes a decoder.

The equalizer 16 is shown with more particularity in FIG. 2 and has a plurality of feed forward sections 32 and a plurality of feedback sections 36. The outputs from each of the feed forward and feedback sections 32 and 36 are input to a summer 34 whose output is provided to an error calculator 38 and to a slicer 40.

The error calculator 38 generates an error that is used by the feed forward and feedback sections 32 and 36 to adapt their parameters to channel variations. The slicer 40 makes hard decisions about the correct value for each symbol. The output of the slicer 40 is provided to the first feedback section 36.

An equalizer controller 30 coordinates and controls the feed forward and feedback sections 32 and 36 of the equalizer 16 by sensing the rate of change of the parameters in each of the sections 32 and 36, and by increasing or decreasing the step size of the parameters accordingly. The controller 30 sets large step sizes for any of the feed forward and feedback sections 32 and 36 that is expected to have large or fast time varying filter coefficients. Conversely, the controller 30 sets small step sizes for any of the feed forward and feedback sections 32 and 36 that is expected to have small or slowly time varying filter coefficients. The step size for each of the feed forward and feedback sections 32 and 36 can be set independently.

Figure 3 of Sommer illustrates one of the feed forward sections 32. The input to this feed forward section 32 is fed to a first of a plurality of delays 50 connected in series. At each symbol clock, the data in

the delays 50 is shifted to the right. The content of each of the delays 50 is input to a corresponding multiplier 52. The outputs of all of the multipliers 52 are summed by a summer 54. The output of the summer 54 is provided as an input to an adaptive multiplier 58 which multiplies the output of the summer 54 by the gain associated with the feed forward section to which the summer 54 belongs. The output of the adaptive multiplier 58 is provided as an input to the summer 34 of FIG. 2.

The coefficients of the adaptive multipliers 52 are adapted using the product of the error from the error calculator 38 and the complex conjugate of the coefficient of the adaptive multiplier 58 as output by a multiplier 62. This product is multiplied with a step size factor by a multiplier 60 to generate a scaled error 61 that is supplied to the adaptive multipliers 52.

The coefficient of the adaptive multiplier 58 is adapted using the product of the error from the error calculator 38 and a step size factor formed by a multiplier 64. A gradient averaging unit 56 functions to average the norm of the gradient indications 53 received from the adaptive multipliers 52 and 58 and to generate a gradient output signal which is input to the equalizer controller 30 shown in FIG. 2. The gradient averaging

units 56 and 76 generate indications of how much the equalizer parameters need to be changed.

Each of the feedback sections 36 is similarly constructed.

Independent claim 1 differs from Sommer because independent claim 1 recites a left shift and a right shift for each input block such that the left shifted input block is multiplied by a first set of equalizer coefficients, such that the unshifted input block is multiplied by a second set of equalizer coefficients, and such that the right shifted input block is multiplied by a third set of equalizer coefficients. Sommer does not show both a right shift and a left shift.

The Examiner asserts that, according to Sommer, input data is left shifted by the delays 70 and this input data is also right shifted by the delays 50. However, the delays 70 do not shift the input data. Instead, the delays 70 operate on output data, not input data, as shown in Figure 2.

Therefore, Sommer does not disclose both left shifting and right shifting input data such that left shifted input data is multiplied by a first set of equalizer coefficients, such that unshifted input data is multiplied by a second set of equalizer coefficients, and

such that right shifted input data is multiplied by a third set of equalizer coefficients.

Citta also does not disclose shifting at all and does not disclose both left shifting and right shifting input data.

Accordingly, one of ordinary skill in the art would not have combined Sommer and Citta so as to produce the invention of independent claim 1.

Therefore, independent claim 1 is patentable over Sommer in view of Citta.

Moreover, independent claim 1 requires multiplying the unshifted input block by the second set of equalizer coefficients. Sommer does not disclose multiplying unshifted input data by equalizer coefficients.

Citta does not disclose data shifting. Therefore, the Examiner might argue that Citta discloses multiplying unshifted input by equalizer coefficients. However, Citta cannot suggest multiplying an unshifted input by equalizer coefficients without disclosing data shifting. Thus, Citta does not disclose a system which would suggest to one of ordinary skill in the art the incorporation of the feature of multiplying unshifted

input by equalizer coefficients into the equalizer shown in Sommer.

Indeed, the equalizers disclosed in Sommer and Citta are not compatible and, therefore, one of ordinary skill in the art would not add the feature of multiplying unshifted input by equalizer coefficients into the equalizer shown in Sommer. Equally important, one of ordinary skill in the art would not know how to add the feature of multiplying unshifted input by equalizer coefficients into the equalizer shown in Sommer and make the equalizer of Sommer work as intended.

Accordingly, for this reason also, one of ordinary skill in the art would not have combined Sommer and Citta so as to produce the invention of independent claim 1.

Therefore, for these reasons also, independent claim 1 is patentable over Sommer in view of Citta.

Independent claim 34 requires applying a finite filter to an unshifted input in addition to applying finite filters to shifted versions of the unshifted input. Sommer does not disclose applying a finite filter to an unshifted input.

That is, independent 34 requires n - 1 data shifters and n finite filters. One of the n finite

filters applies a corresponding set of finite filter coefficients to the input data, whereas each of the other n - 1 finite filters applies a set of finite filter coefficients to a corresponding output of the n - 1 data shifters.

Thus, a finite filter is applied to unshifted data. Sommer does not disclose applying a finite filter to an unshifted input.

As discussed above, Citta does not disclose data shifting. Therefore, the Examiner might argue that Citta discloses applying a finite filter to an unshifted input. However, Citta cannot suggest applying a finite filter to an unshifted input without disclosing data shifting. Thus, Citta does not disclose a system which would suggest to one of ordinary skill in the art the incorporation of the feature of applying a finite filter to an unshifted input into the equalizer shown in Sommer.

Indeed, the equalizers disclosed in Sommer and Citta are not compatible and, therefore, one of ordinary skill in the art would not add the feature of applying a finite filter to an unshifted input into the equalizer shown in Sommer. Equally important, one of ordinary skill in the art would not know how to add the feature of applying a finite filter to an unshifted input into the

equalizer shown in Sommer and make the equalizer of Sommer work as intended.

Accordingly, one of ordinary skill in the art would not have combined Sommer and Citta so as to produce the invention of independent claim 34.

Therefore, independent claim 34 is patentable over Sommer in view of Citta.

Because independent claims 1 and 34 are patentable over Sommer in view of Citta, dependent claims 3-5, 7-13, 33, 36, 37, 63, and 64 are likewise patentable over Sommer in view of Citta.

Moreover, these dependent claims are patentable over Sommer in view of Citta for additional reasons.

For example, dependent claims 4 and 37 recite performing a comparison based upon the addition and the input data.

However, Sommer does not disclose performing a comparison based upon the output of the summer and the input data. Indeed, input data is not supplied to the equalizer controller 30 or to the error calculator 38 as shown in Figure 2.

Accordingly, for this additional reason, one of ordinary skill in the art would not have combined Sommer

and Citta so as to produce the inventions of dependent claims 4 and 37.

Therefore, for this additional reason, dependent claims 4 and 37 are patentable over Sommer in view of Citta.

Dependent claims 5, 9, 12, and 13 recite both left shifting and right shifting, which is disclosed in neither Sommer nor Citta.

Accordingly, for this additional reason, one of ordinary skill in the art would not have combined Sommer and Citta so as to produce the inventions of dependent claims 5, 9, 12, and 13.

Therefore, for this additional reason, dependent claims 5, 9, 12, and 13 are patentable over Sommer in view of Citta.

Dependent claims 33 and 64 recite the further feature of applying a spectral transformation to each block such that the spectral transformation is longer than a block.

Sommer does not disclose spectral transformation. Citta does disclose spectral transformation. However, Citta does not disclose using a spectral transformation that is longer than a data block.

Accordingly, because neither Sommer nor Citta discloses using a spectral transformation that is longer than a data block, one of ordinary skill in the art would not have combined Sommer and Citta so as to produce the inventions of dependent claims 33 and 64.

Therefore, for this additional reason, dependent claims 33 and 64 are patentable over Sommer in view of Citta.

In section 6 of the Office Action, the Examiner rejected claims 2 and 35 under 35 U.S.C. §103(a) as being unpatentable over Sommer in view of Citta and further in view of Rainish.

Dependent claim 2 - As discussed above, neither Sommer nor Citta discloses both left shifting and right shifting input data, and, therefore, it would not have been obvious to combine Sommer and Citta so as to multiply left shifted input data by a first set of equalizer coefficients, multiply unshifted input data by a second set of equalizer coefficients, and multiply right shifted input data by a third set of equalizer coefficients as required by independent claim 1. Moreover, as also discussed above, it would not have been obvious in view of Citta to incorporate the feature of

applying equalizer coefficients to unshifted data into the equalizer disclosed in Sommer.

Rainish shows an apparatus 20/100 that includes first, second, and third samplers. The first sampler samples the early phase of a received signal and the second sampler samples the late phase of a received signal. These early and late phase samples are used to control the third sampler so as to sample a correct phase of the received signal. The correctly sampled signal is then equalized by an equalizer.

Thus, the processing shown in Rainish relates to synchronization and not to equalization. Therefore, Rainish would not have suggested both left shifting and right shifting input data, multiplying the left shifted input data by a first set of equalizer coefficients, multiplying the unshifted input data by a second set of equalizer coefficients, and multiplying the right shifted input data by a third set of equalizer coefficients.

Accordingly, because Sommer, Citta, and Rainish fail to disclose or suggest multiplying left shifted input data by a first set of equalizer coefficients, multiplying unshifted input data by a second set of equalizer coefficients, and multiplying right shifted input data by a third set of equalizer coefficients as

required by independent claim 1, Sommer, Citta, and Rainish would not have been combined by the person of ordinary skill in the art so as to produce the invention of independent claim 1.

Therefore, independent claim 1 is patentable over Sommer in view of Citta and further in view of Rainish. Because independent claim 1 is patentable over Sommer in view of Citta and further in view of Rainish, dependent claim 2 is likewise patentable over Sommer in view of Citta and further in view of Rainish.

Moreover, as also discussed above, it would not have been obvious in view of Citta to incorporate the feature of applying equalizer coefficients to unshifted data into the equalizer disclosed in Sommer. Since Rainish is devoted to synchronization rather the manner of performing equalization, Rainish likewise does not suggest incorporating the feature of applying equalizer coefficients to unshifted data into the equalizer disclosed in Sommer.

Therefore, for this additional reason, independent claim 1 is patentable over Sommer in view of Citta and further in view of Rainish. Because independent claim 1 is patentable over Sommer in view of Citta and further in view of Rainish for this additional

reason, dependent claim 2 is likewise patentable over Sommer in view of Citta and further in view of Rainish for this additional reason.

Dependent claim 35 - With regard to independent claim 34, it has been further discussed above that it would not have been obvious in view of Citta to incorporate the feature of applying equalizer coefficients to unshifted data into the equalizer disclosed in Sommer. Since Rainish is devoted to synchronization rather the manner of performing equalization, Rainish likewise does not suggest incorporating the feature of applying equalizer coefficients to unshifted data into the equalizer disclosed in Sommer.

Therefore, independent claim 34 is patentable over Sommer in view of Citta and further in view of Rainish. Because independent claim 34 is patentable over Sommer in view of Citta and further in view of Rainish, dependent claim 35 is likewise patentable over Sommer in view of Citta and further in view of Rainish.

CONCLUSION

In view of the above, it is clear that the claims of the present application are patentable over the art applied by the Examiner. Accordingly, allowance of these claims and issuance of the above captioned patent application are respectfully requested.

Respectfully submitted,

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APPENDIX
DRAWING CHANGES

REPLACEMENT SHEET MARK UP

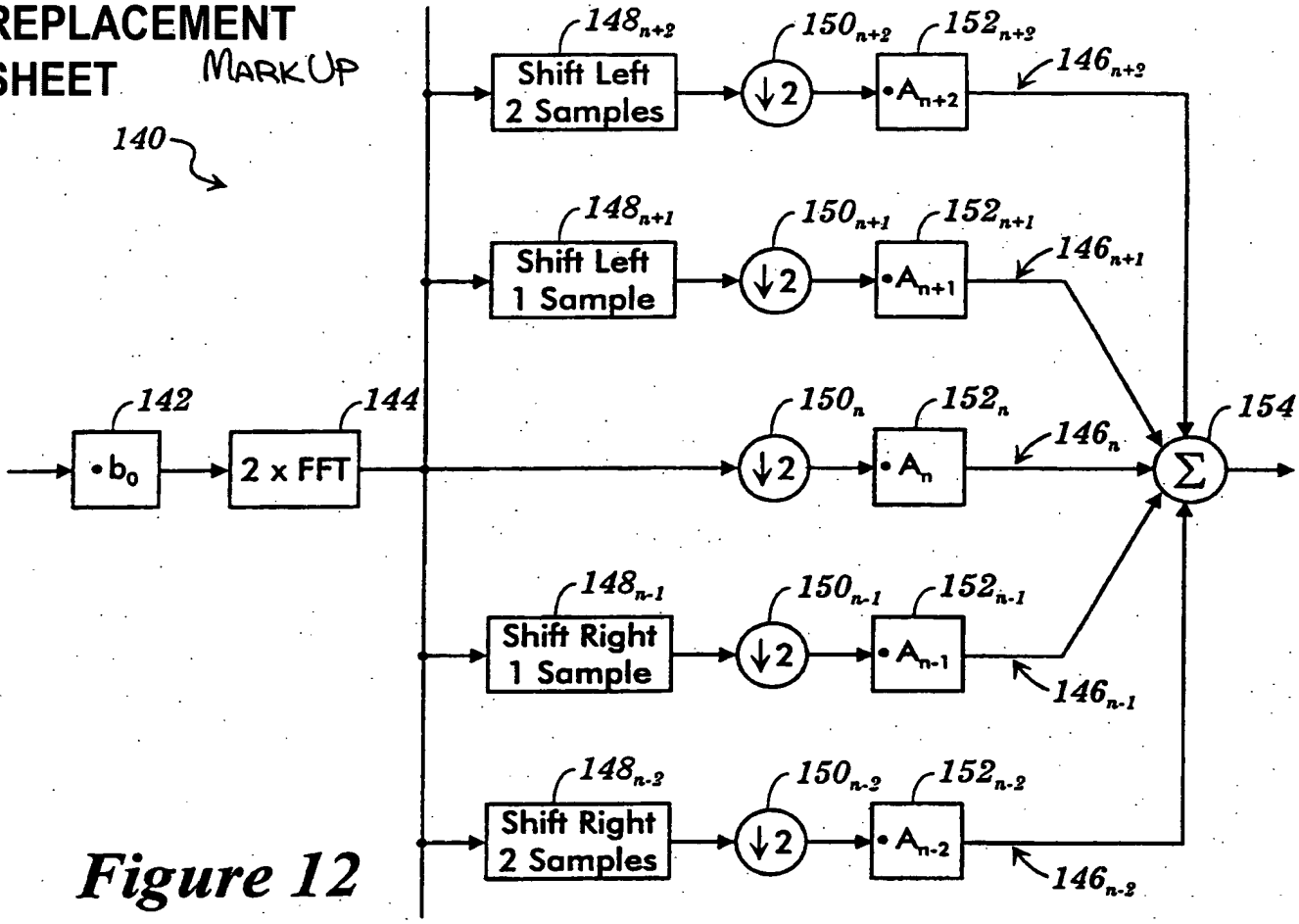

Figure 12

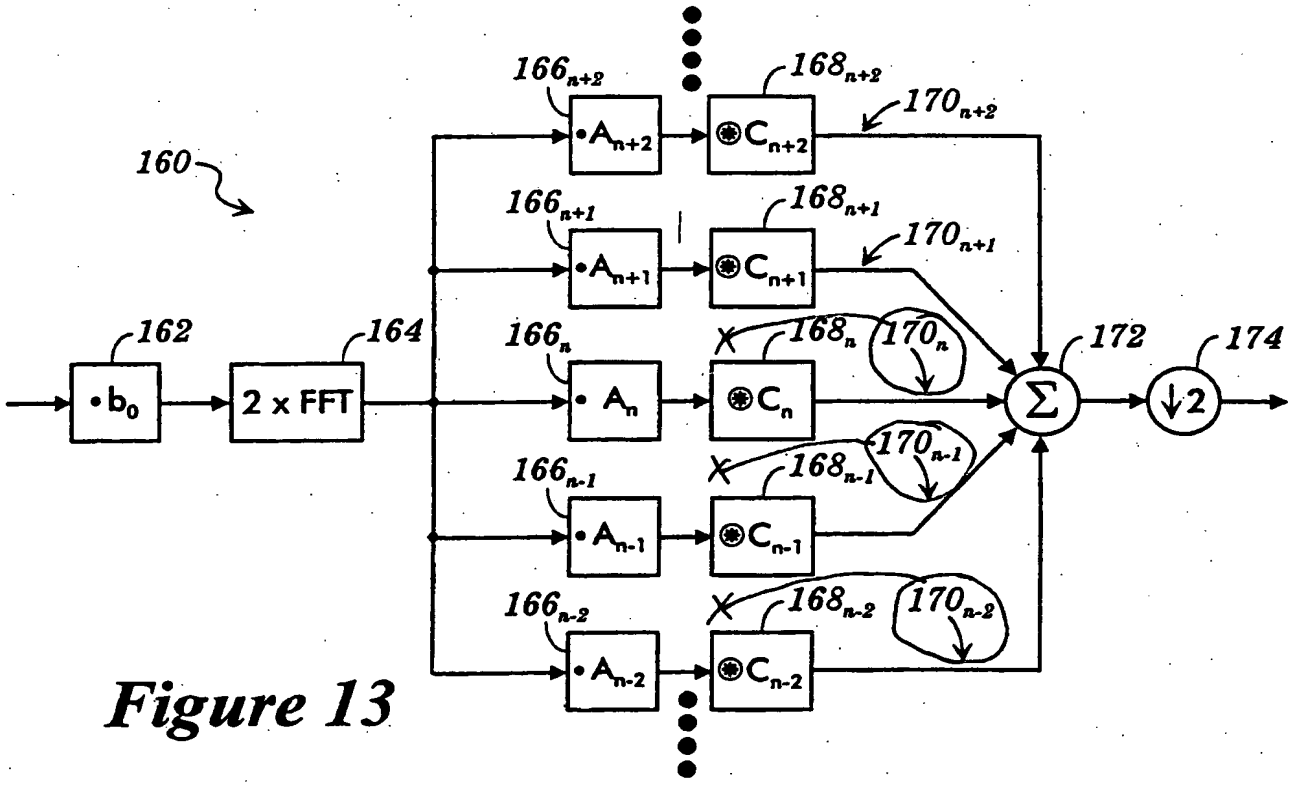

Figure 13